U.S. Department of Transportation
Federal Aviation Administration

Next Generation A/G Communications System

Phase 1
Initial Operational Requirements Document

February 9, 1996

Next Generation A/G Communications System Initial Operational Requirements Document (ORD)

Approved by:

Director of Air Traffic AAT-1	Date
Director of Airway Facilities AAF-1	Date

1. General Description of Operational Capability

1.1 Description of Overall Mission Area

The Federal Aviation Administration (FAA) depends on air/ground (A/G) voice communications to provide Air Traffic Control (ATC) services. Specifically, Very High Frequency (VHF) and Ultra High Frequency (UHF) radio A/G communication links are required to support all phases of flight: from the coordination of ground movements on the airport surface, including gate areas; to the coordination of departures and arrivals in the terminal area; to the coordination needed to support the en route phase of flight. Furthermore, A/G communications are required to ensure aircraft separation, to transmit instructions and clearances, to provide weather services and pilot reports (PIREPs), and to communicate with Automated Flight Service Stations (AFSSs).

1.2 Current Capability

The current ATC A/G radio system is based on an antiquated design formulated in the 1940s. The system consists of voice-based networks that employ Double Sideband Amplitude Modulation (DSB-AM) radios and operate in the 117.975 - 137 MHz VHF band for civil aircraft and the 225 - 400 MHz UHF band for military aircraft. For the VHF band, there exist a total of 760 assignable 25 kHz channels, of which just over 500 are available for ATC use in the United States. The remaining channels are used for other non-ATC aeronautical purposes. The radios operate in a simplex push-to-talk (PTT) fashion, with the same frequency used for uplink (controller-to-pilot) and downlink (pilot-to-controller). As the volume of air traffic has risen, so have the number of frequency assignments (approximately 10,000) for voice channels in the continental United States.

1.3 Planned Capabilities

The planned capability is to provide a next-generation A/G communications system to satisfy the current and identified future functional requirements that are not met through the use of the current voice communications system. The capabilities of the new system would include the following:

- Efficient radio frequency spectrum utilization to meet voice and data requirements
- Reduced susceptibility to Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI)
- Improved communications systems security
- Remote maintenance monitoring for ground elements
- Reduced user workload
- Provide consistent, acceptable voice quality over a range of operating conditions
- Offer a relatively high degree of increased communications capacity
- Offer a significant degree of operational flexibility
- Support a wide range of growth paths
- Allow a great degree of flexibility in system transitional implementation.

2. Operational Concept

2.1 Use Within the NAS

The Next Generation VHF A/G Communications System will be employed by National Airspace System (NAS) users and ATC specialists to perform ATC communications functions. The general roles and responsibilities of pilots and ATC personnel will remain unchanged with the deployment of this system. This system will be used to provide A/G voice and data communications for specific service volumes as presently employed in the NAS. The voice system will operate in a PTT simplex mode with listen-before-talk discipline, as does the existing VHF A/G communications system.

2.2 Impact on Present Operations/Procedures

In order to alleviate transition difficulties, it is essential that the Next Generation A/G Communications System minimize any required changes to present operational procedures, rules,and human interfaces.

2.3 Planned Life-Cycle

The expectation is to use Commercial-Off-The-Shelf (COTS) and commercially Non Developmental Items (NDI) for the Next Generation A/G Communications System that will allow for system evolution and growth via hardware and software replacement. This system will facilitate the increase in air traffic capacity and the introduction of data link in step with technology. These features allow for an evolutionary system life-cycle with no defined obsolescence time frame. The COTS items in the Next Generation VHF A/G Communications System will have a minimum predicted service life of ten years.

3. Capabilities Required

Requirements identified in this section as **"Key Parameters"** represent capabilities and characteristics so significant that failure to meet the threshold would be cause for the concept or system to be reevaluated or the program to be reassigned or terminated.

In accordance with FAA Order 1810.1F, a reference to the organizational assignment of requirements is included in parentheses after each title. AT represents Air Traffic requirements, AF represents Airway Facilities requirements, ASR represents Office of Spectrum Policy and Management requirements, and ASD represents System Architecture and Program Evaluation requirements.

3.1 Operational and Functional Requirements

Requirements in this section are divided into three categories: those which apply to the overall system (voice and data link), those which apply to voice only, and those which apply to data link only.

3.1.1 Operational and Functional Requirements for the Overall System

3.1.1.1 Safety Not Degraded (AT/AF/ASR/ASD)

The Next Generation A/G Communications System shall not cause a degradation in safety when compared with the existing A/G communications system; furthermore, improvement of safety is an overall objective. **(Key Parameter)**

3.1.1.2 Simultaneous Access to Voice and Data Link Communications (AT)

The Next Generation A/G Communications System shall be capable of providing functionally simultaneous access to voice and data link communications.
(Key Parameter)

3.1.1.3 Ground Infrastructure (AF)

The ground infrastructure required for the Next Generation A/G Communications System shall be implemented on an incremental capacity/capability basis.

3.1.1.4 Transmission to Multiple Sectors (AT)

The Next Generation A/G Communications System shall allow an ATC position to have the capability to transmit/receive to/from multiple ATC sectors simultaneously. Party line capability is not applicable between multiple sectors.

3.1.1.5 Circuit Blockage (AT)

The Next Generation A/G Communications System shall detect and override circuit blockage caused when a transmitter is unintentionally keyed. (This is usually referred to as the "stuck microphone" effect.)

3.1.1.6 Security (ASD)

The Next Generation A/G Communications System shall include the capability of providing security measures to protect the system from unauthorized users (e.g., phantom controllers).

3.1.1.7 Coexistence with Present System (AT/ASR)

The design of the Next Generation VHF A/G Communications System shall include capabilities to ensure coexistence with the present analog voice system. The two signals-in-space must coexist during a transition period from analog to digital operations without compromising either Air Traffic Services (ATS) or Aeronautical Operational Control (AOC) voice communications requirements.

3.1.1.8 Ease of Transition (AF)

The Next Generation VHF A/G Communications System shall be capable of a phased implementation. An orderly transition process must allow the present 25-kHz analog DSB-AM A/G communications system to be used or phased out as required. **(Key Parameter)**

3.1.1.9 Party Line Functionality During Transition (AT)

If a mixed old and Next Generation A/G Communications System environment is used within a common group of users (e.g., an en route sector), the Next Generation A/G Communications System shall be capable of supporting party line between the present voice VHF A/G communications system and the new voice system.

3.1.1.10 Automatic Circuit Management (AT)

The Next Generation VHF A/G Communications System shall have the capability of providing automatic circuit (*i.e.*, radio frequency channel) management with manual override.

3.1.1.11 Broadcast Capability (AT)

The Next Generation A/G Communications System shall provide a ground-to-air voice and data link broadcast capability.

3.1.1.12 Failure Detection (AF)

The Next Generation A/G Communications System shall provide a periodic link checking protocol between the ground radios and airborne radios independent of actual user traffic.

3.1.1.13 Failure Recovery (AF)

Upon detection of a ground radio and airborne radio link failure, automatic switching with manual override within the ground network and the airborne radio shall be provided.

3.1.2 Operational and Functional Requirements for Voice Only

3.1.2.1 Air-to-Air Communications (AT)

The A/G Communications System shall provide an air-to-air voice communications capability in addition to the A/G voice communications capability.

3.1.2.2 Dedicated A/G Voice Circuit for Each ATS Controller/Group of Aircraft (AT)

The A/G Communications System shall have the capability to provide a dedicated A/G voice circuit for each air traffic controller and associated group of aircraft.

3.1.2.3 Demand Entry into the A/G Communications System (AT)

The A/G Communications System shall be capable of providing entry of an aircraft's communication transmission into any talk group on demand.

3.1.2.4 Prioritization (AT)

The A/G Communications System shall be capable of providing voice circuit access prioritization. **(Key Parameter)**

3.1.2.5 Back Up Emergency Communications

The Next Generation A/G Communications System shall support back-up emergency communications for enroute facilities and emergency communications requirements for terminal and AFSS facilities.

3.1.2.6 Other Communications (AT)

3.1.2.6.1 Compatible With Existing Emergency Communications

The A/G Communications System shall be compatible with the present 25-kHz analog DSB-AM A/G emergency communications system and with existing Emergency Locator Transmitters (ELTs).

3.1.2.6.2 Capable of Monitoring Emergency Transmissions

The system shall be capable of monitoring ELT transmissions at ATC facilities such as Air Traffic Control Towers (ATCTs), Air Route Traffic Control Centers (ARTCCs), and AFSSs.

3.1.2.6.3 Receipt and Transmission of Emergency Voice at AFSSs

The system shall be capable of providing receipt and transmission of emergency voice communications from/to AFSSs while maintaining voice communications via normal assigned circuits.

3.1.2.6.4 Support for Existing Emergency Communications

The system shall be capable of supporting emergency communications requirements using 25-kHz DSB-AM voice on 121.5, 123.1, and 243.0 MHz.

3.1.3 Operational and Functional Requirements for Data Link Only

3.1.3.1 Data Link Communications Capability (AT)

The A/G Communications System shall provide a data link communications capability. **(Key Parameter)**

3.1.3.2 Prioritization (AT)

The A/G Communications System shall support prioritization of data link messages.

3.1.3.3 ATN Compatibility (ASD)

The A/G Communications System data link subnetwork shall meet the requirements for Aeronautical Telecommunication Network (ATN) compatibility.

3.2 System Characteristics and Performance Requirements

Requirements in this section are divided into three categories: those which apply to the overall system (voice and data link), those which apply to voice only, and those which apply to data link only.

3.2.1 System Characteristics and Performance Requirements for the Overall System

3.2.1.1 Frequency Protected Service Volume (AF)

Ground radio transmitters shall be capable of providing communications with aircraft at up to at least 200 nmi from the ground radio site.

3.2.1.2 Frequency Usage (AT/ASR)

The Next Generation A/G Communications System shall be capable of providing coverage over any designated controlled airspace through the use of a minimal number of frequency assignments.

3.2.1.3 Area Coverage (AT/ASR)

The Next Generation A/G Communications System shall meet or exceed current area coverage capabilities, taking into account spectrum efficiency. Area coverage, which is achieved through site diversity, is defined as the method used to provide coverage for a single ground user or broadcast service when the area of coverage for that user or service is larger than can be covered by a single ground radio outlet. The system will be capable of satisfying this requirement in an acceptable manner without increasing pilot or controller workload or reducing the reliability of communications, either of which could have an impact on safety.

3.2.1.4 EMI Susceptibility (AF)

The Next Generation A/G Communications System shall reduce the degree of EMI susceptibility relative to the present system.

3.2.1.5 Channel Contention (AF/ASD)

The Next Generation A/G Communications System shall provide a technique to minimize the effects of simultaneous transmissions on a single A/G communications channel.

3.2.1.6 Reliability (AF)

The Next Generation A/G Communications System ground radio Mean-Time-Between-Failure (MTBF) shall be greater than or equal to 26,280 hours.

3.2.1.7 Maintainability (AF)

The Next Generation A/G Communications System ground radio Mean-Time-To-Repair (MTTR) shall be less than or equal to 30 minutes.

3.2.1.8 Duration of a Single Loss of Service Event (AT/ASD)

The duration of a single loss of service event in the end-to-end Next Generation A/G Communications System shall not exceed 6 seconds.

3.2.1.9 No Loss of Service Due to a Single Failure (AF)

No single point of failure of the Next Generation A/G Communications System equipment or system installation shall cause loss of service.

3.2.1.10 Preventative Maintenance (AF)

Preventative maintenance on the Next Generation A/G Communications System equipment shall not be required more than twice per year or once every six months.

3.2.1.11 Enhanceability (AF)

The Next Generation A/G Communications System shall permit improvements to hardware and software elements without requiring a change to the system architecture or other NAS components.

3.2.1.12 Scalability (AF)

The Next Generation A/G Communications System shall meet the specified capacity, functionality, and capability requirements for all ATC facilities, from the largest ARTCC to the smallest single ATCT.

3.2.2 System Characteristics and Performance Requirements for Voice Only

3.2.2.1 Channel Capacity (AF/ASD)

The Next Generation A/G Communications System shall provide an increased A/G voice channel capacity relative to current NAS communications. **(Key Parameter)**

3.2.2.2 Voice Quality (AT/ASD)

Voice communications for the A/G Communications System shall be clearly intelligible and of acceptable quality from ATC's perspective.

3.2.2.3 Audio Throughput Delay (AT/ASD)

The end-to-end delay from audio into the transmitting controller's desk to audio out of the airborne receiving station shall be no greater than 250 milliseconds.

3.2.2.4 Transmit Audio Clipping (AT)

The Next Generation A/G Communications System shall be capable of preventing audio clipping during PTT activation.

3.2.2.5 Service Availability for Voice (AF/ASD)

The service availability of the voice ground communication system, of which the Next Generation A/G Communications System will be a part, shall be 0.99999 for voice service. **(Key Parameter)**

3.2.3 System Characteristics and Performance Requirements for Data Link Only

3.2.3.1 Data Link Message Lengths (AT/ASD)

The Next Generation A/G Communications System shall be capable of supporting variable length messages, and will provide a data link capability sufficient to deliver tactical ATS messages in accordance with "Operational Requirements for the Aeronautical Data Link System" dated January 3, 1995.

3.2.3.2 Undetected Message Error Rate/Message Integrity (AT)

The probability that a message containing an undetected error will get to the end user via the Next Generation A/G Communications System shall not exceed
1×10^{-7}, *i.e.*, on average, 1 message with an error for every 10 million messages.

3.2.3.3 Message Delivery Time by VHF A/G Subnetwork (AT/ASD)

Delivery of short tactical data link messages of 24 octets of application data or less shall be delivered within 0.6 seconds (mean value), and within 0.7 seconds with a probability of at least 0.95.

3.2.3.4 Service Availability for Data (AF/ASD)

The service availability goal of the end-to-end communication system, of which the Next Generation A/G Communications System will be a part, shall be 0.999 for data service.

3.3 Machine-Human Interface Requirements

3.3.1 Machine-Human Interface Design for Voice (AT)

For voice communications, while other operational modes may be available, the Next Generation A/G Communications System shall emulate the basic PTT mode of the current system.

3.3.2 Machine-Human Interface Design for Data Link (AT)

User interfaces for data link functions of the Next Generation A/G Communications System will be in accordance with the messages and message protocols specified in RTCA DO-219, Minimum Operational Performance Standard for ATC Two-Way Data Link Applications.

4. Critical Operational Issues

4.1 System Quantities

The current A/G communications system facilities consist of:

682 Remote Communications A/G (RCAG) facilities
1,718 Radio Communications Outlet (RCO) facilities
1,294 Remote Transmitter/Receiver (RTR) facilities

4.2 Schedule Constraints

Potential constraints on deployment of the Next Generation A/G Communications System include the VHF Digital Link (VDL) standardization process, and development of data link specifications, both of which are currently being undertaken by the FAA.

4.3 Impact If Capability Is Not Achieved

If the Next Generation VHF A/G Communications System is not implemented according to schedule, the following issues could impact the NAS.

4.3.1 Safety

Unauthorized use of ATC channels, described in the Next Generation A/G Communications System Mission Needs Statement (MNS-137), poses a safety impact to airspace users. Furthermore, increasing numbers of cases of radio frequency interference, also described in section 3.a(2) of MNS-137, adversely impact the safety of the NAS.

4.3.2 Capacity

The current system is approaching its maximum spectrum capacity in many congested metropolitan areas and hubs and will be unable to meet the increase in operational or service demand. This will result in increased system-imposed user delays. Even a modest growth rate of four percent per year in required channels, based upon historical data, shows that the spectrum will be exhausted by the year 2002 in high traffic areas.

4.3.3 Cost

The current system is obsolete and its operating cost is expected to increase significantly with time as radio equipment continues to deteriorate.

4.3.4 Technical Support

Major support issues include the lack of a program or contract for replacement of obsolete radios beyond 1997, and the “reengineering" of components necessary to support the vast majority of the existing A/G radios by the FAA Logistics Center (FAALC).

4.4 Standardization and Commonality

The International Civil Aviation Organization (ICAO) has selected the VDL voice and data link system as the future A/G communications system to meet the set of identified requirements.

4.5 User Requirement

Multimode transceivers (DSB-AM and VDL, including vocoder) that support voice and data link communications must be available for airborne users to ensure a viable Next Generation A/G Communications System. Rulemaking procedures that would require mandatory carriage of such transceivers by aircraft in the NAS are To Be Determined (TBD).

5. Support Concept

5.1 Maintenance Concept

Two levels of maintenance are required to support the Next Generation Communications System. These levels are depot and on-site.

5.1.1 Depot-Level Maintenance (AF)

In this case the FAALC would act as item managers who handle the logistics of shipping faulty Lowest Replaceable Units (LRUs) to the vendor for repair and also coordinate the fielding of spare LRUs. For the lease/buy option the depot maintenance philosophy is TBD, although it is likely that some interim contractor support would be necessary.

5.1.2 On-Site Maintenance (AF)

FAA field technicians shall perform on-site maintenance services at individual A/G Radio Communications sites. Technicians will remove and replace suspect LRUs and ship them to the FAA depot for appropriate action.

5.1.3 Maintenance Reporting (AF)

A remote maintenance monitoring system shall provide data for the maintenance management process, which includes maintenance reporting related to hardware and software configuration management. The FAALC will develop maintenance management databases from which repair costs can be assessed and then projected into future years of system deployment.

5.1.4 Software Maintenance (AF)

Software maintenance issues are currently being examined for the Next Generation A/G Communications System. The deployment of software maintenance systems and the assignment of responsibilities between the FAA and the vendor will both depend on the procurement strategy chosen for the program.

5.1.5 Remote Maintenance Functions

To conform with FAA maintenance philosophy, a remote maintenance support system must be implemented as part of the Next Generation A/G Communications System. One goal of remote maintenance monitoring is to reduce the on-site preventative maintenance occurrences from quarterly to annually. The existing analog VHF A/G communications system does not provide a remote maintenance capability.

5.1.5.1 Remote Maintenance Monitoring (AF/ASD)

The Next Generation A/G Communications System remote maintenance monitoring capability shall monitor the status, integrity, and performance of system resources.

5.1.5.2 Remote System Control (AF)

Remote system control functions of the Next Generation A/G Communications System shall include: startup, shutdown, frequency setting, squelch adjustment, and alleviation of a stuck microphone condition.

5.1.5.3 Other Remote Maintenance Functions (AF)

Maintenance personnel shall conduct fault diagnosis, fault isolation to the LRU level, hardware configuration management, and certification of Next Generation A/G Communications System operations. These functions will be performed remotely where practical.

5.2 Logistics Considerations

5.2.1 Documentation (AF)

The contractor shall supply, with each Next Generation A/G Communications System LRU, an instruction book written in accordance with Appendix I of
FAA-D-2494\b and comprehensive COTS operations and technical manuals, which include schematic and wiring diagrams, printed circuit board drawings, and parts listings.

5.2.2 Training (AT/AF)

The FAA Academy will approve training and instruction for AF technicians. With the introduction of data link capabilities, AT personnel training may be considered significant enough to warrant development of an independent course (TBD).

5.2.3 Physical Construction

The following requirements apply to ground-based Next Generation VHF A/G Communications System LRUs only.

5.2.3.1 LRU Removal and Replacement (AF)

Next Generation A/G Communications System LRUs will permit removal and replacement by one person and shall be limited to 37 lbs maximum.

5.2.3.2 Equipment Construction (AF)

Equipment construction strength shall prevent any damage from normal handling in loading, shipping, unloading, and setting into position for installation.

5.2.3.3 LRU Equipment (AF)

LRU equipment shall use standard racks.

5.2.3.4 LRU Cabinet Loading Conditions (AF)

Fully loaded Next Generation VHF A/G Communications System LRU cabinets shall not exceed a maximum weight distribution of 175 lb/ft^2.

5.2.4 Operating Environment (AF)

The following environmental conditions were derived from paragraph 3.2.1.2.4 of FAA-G-2100F, FAA Specification of General Requirements for Electronic Equipment, dated November 15, 1993.

Temperature range:	-10^o to 50^oC
Relative humidity:	5 to 90%
Altitude:	0 to 10,000 feet above sea level

5.2.5 Non-Operating/Storage Environment (AF)

Temperature range:	-50^o to 70^oC
Relative humidity:	Up to 100% including condensation due to temperature changes
Altitude:	0 to 50,000 feet above sea level

6. Critical System Characteristics

Critical system characteristics shall be met fully for the system to be operationally viable. These characteristics will serve as the performance criteria for the success of the overall program, along with cost and schedule criteria. Appendix I, Requirements Correlation Matrix, contains this information.

7. Infrastructure Support

7.1 System Level Interfaces for the Ground Equipment (ASD)

7.1.1 VHF Radio to Antenna

Usage of the existing ground VHF antennas will be considered on a per-site basis due to the fact that multicouplers, combiners, linear power amplifiers and/or filters are installed in some locations. Where possible, an interface identical to the existing Radio-to-Antenna connection shall be provided.

7.1.2 VHF Radio to RIU

A digital interface between the VHF Radio and the Radio Interface Unit (RIU) shall be provided, and the interface will support voice and data signals.

7.1.3 VHF Radio to Source Power

Existing source power systems, including backup power, shall be employed at the Remote Radio Sites.

7.1.4 VHF Radio to Time Source

The VHF Radio shall use as its primary time source an internal oscillator with less than or equal to $\pm$ 10 parts per million drift. The VHF Radio shall be capable of synchronizing its locally generated time with that received from an external time source.

If a time signal is present at the VHF Radio to Time Source interface, the VHF Radio shall automatically synchronize time with the external time source. The external time source shall be synchronous with Coordinated Universal Time.

7.2 Facility Requirements (AF)

The Next Generation A/G Communications System shall use existing sites to the maximum extent possible.

Appendix I: Requirements Correlation Matrix

Requirements Correlation Matrix

Requirement	Sec #	Threshold	Objective
Operational & Functional Requirements 3.1			
	3.1.1		
	3.1.2		
	3.1.3		
	3.1.4		

(Matrix is to be supplied at a later date)

Appendix II: Definitions

Certification: The technical verification performed prior to commissioning and/or service restoration after a scheduled/unscheduled interruption affecting certification parameters, and periodically thereafter inclusive of the insertion of the prescribed entry in the facility maintenance log. The certification validates that they system is providing an advertised service to the user, and/or that the system/equipment is capable of providing that advertised service. It includes independent determination about when a system/equipment should be continued in, restored to, or removed from service.

Certification Parameter: Certification parameters are selected critical indicators of the quality of the required or advertised services being provided to the user of systems, subsystems, and equipment.

Commercial Off-the-Shelf Hardware: Item of hardware that is available in the commercial marketplace.

Commercial Off-the-Shelf Software: Standard industry code required to field and maintain an open system architecture, e.g., operating system software, network management software, and diagnostic software for each Lowest Replaceable Unit.

Enhanceability: The capability of a system to interface with additional unspecified systems, process data from those systems, and accommodate improvements to hardware and software elements, with the original architecture (no system or architecture modifications required).

Key Parameter: Capabilities and characteristics so significant that failure to meet the threshold is cause for the concept or system to be reevaluated.

Lowest Replaceable Unit (LRU): The lowest replaceable component at the site.

Mean Time To Repair: The Mean Time to Repair (MTTR) includes diagnostic time, removal of the failed LRU, replacement and installation of the new LRU including any adjustments or data loading necessary to initialize the LRU, and all adjustments required to return the subsystem to normal operation and to perform certification.

Non-Developmental Item: Any of the following:

a. Item of supply that is available in the commercial marketplace (COTS).

b. Previously developed item of supply that is in use by a department or agency of the United States, a state or local government, or a foreign government.

c. An item described in “a” or “b,” above that requires only minor modification to meet the procuring agency requirements, including modified COTS. “Minor modifications” are those that do not adversely affect safety, durability, reliability, performance, interchange ability of the part or assemblies, maintainability, weight where weight is significant, or any other significant objective of the end item.

Objective: An operationally significant increment above the threshold. An objective value may be the same as the threshold when an operationally significant increment above the threshold is not identifiable or useful.

Scalability: The ability to increase the number of system components using the original architecture.

Threshold: Minimum or maximum acceptable operational value for system capability or characteristic which, in the user's judgment, is necessary to provide an operational capability that will satisfy the mission need.

Appendix III: Acronyms

A/G	Air/Ground
AF	Airway Facilities
AFSS	Automated Flight Service Station
AOC	Aeronautical Operational Control
ARTCC	Air Route Traffic Control Center
ASD	System Architecture and Program Evaluation
ASR	Office of Spectrum Policy and Management
AT	Air Traffic
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
COTS	Commercial-Off-The-Shelf
DSB-AM	Double Sideband Amplitude Modulation
ELT	Emergency Locator Transmitter
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FAALC	FAA Logistics Center
ICAO	International Civil Aviation Organization
LRU	Lowest Replaceable Unit
MTBF	Mean-Time-Between-Failure
MTTR	Mean-Time-To-Repair
NAS	National Airspace System
NDI	Non-Developmental Item
nmi	Nautical Mile
ORD	Operational Requirements Document
PIREP	Pilot Report
PTT	Push-To-Talk
RCAG	Remote Communications Air/Ground facility
RCO	Radio Communications Outlet
RFI	Radio Frequency Interference
RIU	Radio Interface Unit
RTR	Remote Transmitter/Receiver facility
TBD	To Be Determined
UHF	Ultra High Frequency
VDL	VHF Digital Link
VHF	Very High Frequency